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Getting to the Heart of the Matter: Written Disclosure, Gender, and Heart Rate

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Abstract

Objective—The present study examined gender differences in the psychologic and physical symptom changes associated with written disclosure.

Methods—Male (n = 48) and female (n = 46) college students were assigned to either a written disclosure condition or a control writing condition. Participants in each condition wrote on 3 consecutive days for 20 minutes each session. Heart rate was recorded during each writing session and the narratives were examined for linguistic content. Participants completed measures of psychologic and physical health at baseline and again 1 month later.

Results—Participants assigned to the written disclosure condition reported significantly greater psychological and physical health benefits at follow up compared with the control group participants. No significant gender differences were found among those participants assigned to the written disclosure condition. Additionally, although heart rate reactivity and changes in the use of words denoting positive emotion, negative emotion, and cognitive appraisal significantly differed between the writing conditions, no significant gender differences in these variables were found among individuals assigned to the written disclosure condition.

Conclusions—Written disclosure is associated with significant improvements in both psychologic and physical health for men and women. There was no support for the notion that men may derive greater benefits than women from written disclosure. Furthermore, the results of this study indicate that changes in physiological reactivity and word use associated with written disclosure do not differ between men and women.

Keywords

written disclosure; gender; heart rate; emotional expression

Keywords

$DASS_{21}$ = Depression Anxiety and Stress Scale; **HR** = heart rate; **LIWC2001** = Linguistic Inquiry and Word Count; **PDS** = Posttraumatic Stress Diagnostic Scale; **PILL** = Pennebaker Inventory of Limbic Languidness

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INTRODUCTION

Since its publication in 1986, Pennebaker and Bealls' written disclosure procedure has generated a long line of work examining the physical health benefits of writing about traumatic or stressful experiences (1,2). In general, these studies have indicated that, relative to those who write about emotionally neutral topics, individuals who write about traumatic or stressful life experiences report fewer physician visits and physical health complaints at follow up.

Generally, in the procedure developed by Pennebaker, individuals write about their deepest emotions regarding the most traumatic or stressful event of their lives, typically over 3 consecutive days, for approximately 20 minutes each session. Participants assigned to the control condition write for the same amount of time and the same number of sessions but are instructed to objectively write about how they spend their time. A previous review of the literature indicated that outcome effects resulting from written emotional disclosure are robust (3).

Although there has been a plethora of work examining the effects of written disclosure, one question that still remains unanswered is whether men and women obtain the same benefits from the written disclosure procedure. From the results of his meta-analysis, Smyth (3) suggested that men may derive greater benefits from written disclosure than women. However, because none of the studies included in his meta-analysis directly examined the effects of gender on written disclosure, Smyth (3) used the proportion of men in each study as a moderating variable in a between-study examination of effect size. Using this approach, Smyth showed that studies with a higher proportion of men had significantly larger overall effect sizes for outcome relative to studies with a lower proportion of men. Although a number of studies have examined the effects of written disclosure since Smyth's meta-analysis, investigators have yet to directly investigate whether gender influences outcome.

Despite the lack of empirical attention to gender differences and written disclosure, in response to Smyth's meta-analysis results, a number of investigators have speculated that the written disclosure procedure might be particularly beneficial for men because it provides an anonymous context for men to disclose feelings of distress and vulnerability (5–9). Strengthening this tentative hypothesis for why men might derive particular benefits from written disclosure is the finding that relative to men, women typically report that their relationships are characterized by greater intimacy, emotional disclosure, and empathy (10). Thus, it is possible that the nature of men's relationships, perhaps a function of traditional cultural expectations, makes it less acceptable and therefore less likely for men to openly disclose emotions about a stressful or traumatic experience. Consequently, it is plausible that men may derive more benefits than women when given the opportunity to disclose their feelings about personally distressing experiences in an anonymous but structured setting.

Another reason to believe that men may derive greater benefits from written disclosure than women is that men are more inclined to use problem-focused coping approaches (11). Such an approach may be related to the use of more causal-and insight-related words in men's writing. In prior research, the use of such words has been related to greater improvements in physical health at follow up for individuals assigned to written disclosure groups (e.g., (12,13)). In addition to word use, greater physiological arousal, as indexed by salivary cortisol (14,15) and heart rate (HR) reactivity (16), during the first writing session has been associated with greater psychologic and physical symptom improvements for individuals assigned to written disclosure groups. Therefore, to better understand the process by which men may derive greater benefits from written disclosure, we also examined the extent to which men and women participants differed in word use and physiological reactivity to the writing sessions.

Thus, the present study examined gender differences using both physical and psychologic health outcome measures and investigated how men and women may differ in their responses to the writing task by examining the linguistic pattern of the narratives and changes in physiological reactivity (i.e., HR reactivity). Given Smyth's (3) findings and the theoretical support for gender differences in the effects of written disclosure, it was expected that men would report greater psychologic and physical health benefits associated with written disclosure than women. In addition, we expected to find differences between men and women in how they wrote about their traumatic experiences, such that women were expected to use more positive and negative emotion words compared with men, and men using more insight/causal-related words relative to women. Furthermore, given the expectation that men would derive greater benefits from written disclosure than women, and that increased physiological arousal during the first writing session has been associated with beneficial outcome (14–16), it was also expected that men would show greater HR reactivity during the first writing session relative to women.

METHOD

Recruitment and Retention

Participants were randomly selected from an undergraduate introductory psychology course at a large urban university. Potential participants were asked to volunteer for a study, approved by the Temple University Institutional Review Board, in which they would be asked to write about stories related to their lives over several sessions. Because the time commitment involved in this study was greater than that required for course research credit, individuals received both course credit and financial compensation ($10) in exchange for their participation. A total of 99 individuals (49 women) participated in the study. Two participants (one woman) assigned to the written disclosure condition and three participants (2 women) assigned to the control condition completed all three writing sessions but failed to return for the follow-up assessment. These participants did not differ from those who completed the study in terms of their scores on the questionnaire data at baseline or in terms of demographic characteristics. The remaining 94 participants completed all three writing sessions and returned for the follow-up session 1 month later (95% retention rate); these 94 participants were included in subsequent data analyses.

Participant Characteristics

Participants were 94 (men, $n = 48$; women, $n = 46$) college students with a mean age of 20.9 years (standard deviation = 4.8). Participants were randomly assigned (within gender) to either the written disclosure condition ($n = 51$) or the control writing condition ($n = 43$). The majority of the participants were white ($n = 57$), with the remaining participants representing a diversity of racial groups (black $n = 15$, Hispanic $n = 8$, Asian-American $n = 2$, and "other" or mixed racial background $n = 12$). As can be seen in Table 1, the participants assigned to the disclosure condition wrote about highly personal and upsetting experiences that were similar to those written about by participants in other studies of written disclosure (6,7).

Measures

Depression and Anxiety Stress Scale–21-Item—The Depression and Anxiety Stress Scale–21-Item ($DASS_{21}$ (17)) is a 21-item questionnaire consisting of items relating to depression, hyperarousal, and stress. A Likert-type scale is used to rate items according to symptoms experienced in the past week, ranging from 0 (not at all) to 3 (most of the time). Factor analytic studies with both clinical and nonclinical samples have shown that the $DASS_{21}$ items can be reliably grouped into three scales: depression, anxiety, and stress (18) and that the measure differentiates between symptoms of anxiety and depression, as well as between symptoms of physical arousal and symptoms of generalized anxiety (e.g., tension

(18)). The depression subscale is composed of items that measure symptoms associated with depressed mood (e.g., sadness, worthlessness), whereas the anxiety subscale includes items that are related to symptoms of physical arousal, panic attacks, and fear (e.g., trembling, faintness). Items that measure symptoms such as tension, irritability, and tendency to overreact to stressful events comprise the stress subscale.

The $DASS_{21}$ depression subscale has been shown to provide a better separation of the features of anxiety and depression than other existing measures of depression and anxiety (17–19). Two-week retest reliabilities for the $DASS_{21}$ subscales were found to be relatively high at 0.71, 0.78, and 0.81, for the depression, anxiety, and stress scales, respectively (19). The $DASS_{21}$ was included in this study for the purpose of examining psychologic health outcome in depression, anxiety, and stress symptoms.

Pennebaker Inventory of Limbic Languidness—The Pennebaker Inventory of Limbic Languidness (PILL (20)) is a 54-item scale that assesses the frequency of common physical symptoms and sensations. Cronbach alphas range from 0.88 to 0.91 and 2-month retest reliability ranges from 0.79 to 0.83. Previous research indicates that high scores on the PILL are significantly associated with a greater frequency of health center visits, and greater number of days sick and/or work-related absences (20). The overall score on the PILL is obtained by summing the total number of items for which the individual endorsed experiencing the symptom at least once every month. Items include physical symptoms such as runny or congested nose, chills, headaches, fever, and nausea. The PILL was included in this study because it is commonly used in studies of written disclosure and it is a sensitive measure of change in physical symptoms (e.g., 14,15,21,22).

Linguistic Inquiry and Word Count, 2001—The Linguistic Inquiry and Word Count, 20001 (LIWC2001 (23)) is a computerized text analysis program that searches individual text files and computes the percentage of words in a variety of word categories (e.g., negative emotion, positive emotion, and insight/causality). The program uses an extensive dictionary file comprised of over 2100 words and word stems to calculate the total number of words, sentences, percentages of unique words, and dictionary words. The sums of each of these scales are converted to a percentage of total words to correct for differences in text length between participants.

For this study, the written essays for each session of each participant were converted to a computer text file, and a linguistic analysis of these text passages was conducted using the LIWC2001. The linguistic indices examined in this study were negative emotion (e.g., sad, afraid, hate, worthless), positive emotion (e.g., happy, love, pride), and insight/causality (e.g., think, know, because). These categories were chosen based on anticipated gender differences in word use.

Physiological Reactivity—Heart rate activity was included in the study to examine physiological arousal during the writing sessions. HR was selected because, although it has been previously shown to be a detectable and sensitive measure of changes in one's psychologic and arousal state (24), it is not sensitive to stimulus novelty, unlike other physiological indices such as salivary cortisol (25). In this study, participants' HR was recorded continuously for both a 5-minute baseline period before the writing session and during each 20-minute writing session using the Polar S810 HR Monitor (Lake Success, NY). The Polar HR Monitor is an ambulatory system that consists of a wristwatch receiver and the T61 transmitter chest strap. A water-soluble transmitting gel was applied to the transmitter chest strap to facilitate conduction. These signals were transmitted to the wristwatch receiver that acquired the interbeat interval (IBI) between R waves, which was subsequently downloaded to a computer text file. HR obtained using the Polar Monitor system has been found to be highly correlated

with cardiovascular recordings during exercise, mental challenges (e.g., arithmetic challenges), and resting periods, indicating that the system is a reliable device for recording HR activity in the laboratory (26). Change scores (*M* writing session HR − *M* baseline HR) were computed to examine HR reactivity during the writing sessions.

Procedure

On arrival for the first session, participants provided written informed consent and were then asked to complete a series of questionnaires, which included a demographics questionnaire, the PDS, the $DASS_{21}$, and the PILL. After completion of the questionnaires, participants were asked to put on the HR chest strap, which they were told would record their bodily reactions, and were given instructions for the resting period. During the 5-minute resting period, participants were left alone in a dimly lit room after they had been instructed to relax by focusing on their breathing and clearing their mind of all thoughts.

The writing session immediately followed the resting period. Specific writing instructions for each writing condition and session were replicated from the standard instructions developed by Pennebaker (1). Briefly, participants in the written disclosure condition were asked to write about the most distressing experience of their lives with as much emotion and feeling as possible. Consistent with the standard protocol, they were instructed that they could write about the same or different events during each writing session. Those assigned to the control writing condition were asked to write about how they spend their time without any emotion or opinions. Also consistent with the standard protocol, participants in both conditions wrote continuously for 20 minutes each session. The writing sessions took place on 3 consecutive days, with participants writing alone in a private room. After the instructions for the session were presented to the participant, the HR monitor was started and the participant was left alone to complete the writing assignment. After 20 minutes, the experimenter entered the room and stopped the HR recording.

With the exception of the questionnaires, the same procedure was replicated for the writing sessions completed on the following 2 days. Participants then returned 1 month later to complete the $DASS_{21}$ and the PILL, after which they were fully debriefed regarding the purpose of the study. A 1-month follow-up assessment was used to be consistent with earlier studies of written disclosure (14,15).

RESULTS

Outcome Assessment

Participants in the two conditions did not significantly differ in terms of mean age, gender, or racial background. Descriptive information for the outcome measures at baseline and at follow-up assessment, as a function of writing condition and gender, is presented in Table 2.

Psychologic and Physical Health Outcomes of Written Emotional Disclosure

To examine condition and gender differences on the outcome measures, a 2 (condition) × 2 (gender) × 2 (time) repeated-measures analysis of variance (ANOVA) was conducted, with condition and gender as the between-subjects variables and time (baseline, 1-month follow up) as the within-subject variable, separately for each outcome measure ($DASS_{21}$–depression, $DASS_{21}$–anxiety, $DASS_{21}$–stress, and PILL).

Results indicated a significant main effect for writing condition for the $DASS_{21}$ depression subscale ($F[1,90] = 4.30$, $p < .05$, $r_{\text{effect size}} = 0.21$ (27)); however, this main effect was qualified by a significant condition by time interaction ($F[1,90] = 7.95$, $p < .01$, $r_{\text{effect size}} = 0.28$). No other significant main or interaction effects were found. Further examination of the significant

condition by time interaction with follow-up simple main-effects analysis indicated that the disclosure participants reported significantly fewer depressive symptoms compared with the control participants at follow up ($p < .01$, $r_{\text{effect size}} = 0.36$). Within-group tests (paired *t* tests) indicated that the disclosure participants reported significantly fewer depressive symptoms at follow up relative to baseline ($t[50] = 4.15$, $p < .001$, $r_{\text{effect size}} = 0.52$), whereas the change in depressive symptoms was not significant for the control participants. To examine whether gender differences in depression symptom reporting over time existed, a one-way ANOVA was conducted using gender as the between-subjects variable (for disclosure condition) and depression change score (baseline–follow up) as the dependent variable. No gender differences in depression symptom reporting over time were found.

Examination of the $DASS_{21}$ anxiety subscale indicated a significant writing condition by time interaction ($F[1,90] = 9.52$, $p < .01$, $r_{\text{effect size}} = 0.31$), although no other significant effects emerged. Follow-up simple main-effects analysis of the significant interaction indicated that the disclosure participants reported significantly fewer symptoms of anxiety compared with the control participants at follow up ($p < .01$, $r_{\text{effect size}} = 0.24$). Within-group analyses indicated that the disclosure participants reported significantly fewer anxiety symptoms at follow up relative to baseline ($t[50] = 2.89$, $p < .01$, $r_{\text{effect size}} = 0.38$), whereas the change in symptoms was not significant for the control participants. Additional ANOVA tests for the disclosure participants indicated that there were no differences between men and women in reported anxiety symptoms over time.

A main effect for writing condition for the $DASS_{21}$ stress subscale was found ($F[1,90] = 10.23$, $p < .01$, $r_{\text{effect size}} = 0.32$), although it was also qualified by the significant condition by time interaction ($F[1,90] = 24.33$, $p < .01$, $r_{\text{effect size}} = 0.46$). Again, no other significant effects emerged. Follow-up simple main-effects analysis to further explore the significant interaction again revealed that the disclosure condition participants reported significantly fewer stress-related symptoms at follow up compared with the control condition participants ($p < .01$, $r_{\text{effect size}} = 0.33$). Within-group analyses also indicated that the disclosure participants reported significantly fewer stress symptoms at follow up compared with baseline ($t[50] = 6.06$, $p < .001$, $r_{\text{effect size}} = 0.65$), whereas the change over time was not significant for the control participants. For the disclosure participants, the change in stress symptoms over time did not differ between men and women.

Findings for physical symptom complaints (i.e., PILL) were consistent with the findings for psychologic health. Specifically, a significant writing condition by time interaction was found ($F[1,90] = 17.56$, $p < .01$, $r_{\text{effect size}} = 0.40$), but there were no other significant main or interaction effects. Follow-up tests of simple main effects indicated that the disclosure participants reported fewer physical complaints at follow up relative to the control participants ($p < .01$, $r_{\text{effect size}} = 0.31$). Within-group tests indicated that the disclosure participants reported significantly fewer physical symptom complaints at follow up relative to baseline ($t[50] = 3.97$, $p < .001$, $r_{\text{effect size}} = 0.49$), whereas the change over time was not significant for the control participants. For the disclosure participants, the change in physical symptoms over time did not differ between men and women. It should be noted that across all of the outcome measures, the largest effect size for the three-way gender interaction was $r_{\text{effect size}} = 0.03$.

Gender Differences in the Process of Written Disclosure

Linguistic Analyses—Table 3 displays the proportion of word use for each linguistic category examined in this study as a function of condition and gender. To investigate linguistic differences in written disclosure, a 2 (condition) = 2 (gender) ANOVA was conducted separately for the average proportion of positive emotion words, average proportion of negative emotion words, and average proportion of insight/causality-related words derived from the LIWC program. Findings indicated that, as would be expected, the disclosure participants used

more negative emotion words (mean = 1.23, standard deviation [SD] = 0.48) compared with the control participants (mean = 0.29, SD = 0.24) (F[1,91] = 134.54, $p < .001$, $r_{\text{effect size}} = 0.60$). The disclosure participants also used more positive emotion words (mean = 0.90, SD = 0.54) relative to the control participants (mean = 0.48, SD = 0.23) (F[1,91] = 21.40, $p < .001$, $r_{\text{effect size}} = 0.19$). Similarly, the disclosure participants used more insight/causality-related words (mean = 3.74, SD = 1.06) compared with the control participants (mean = 1.87, SD = 0.71) (F[1,91] = 111.08, $p < .001$, $r_{\text{effect size}} = 0.55$). A significant main effect for gender was also found (F[1,91] = 7.44, $p < .01$, $r_{\text{effect size}} = 0.08$) such that women participants used a greater proportion of insight/causality-related words (mean = 3.14, SD = 1.47) relative to men (mean = 2.65, SD = 1.10). However, no significant gender by condition interaction was found for any of the linguistic categories (largest $r_{\text{effect size}} = 0.03$).

Physiological Reactivity—To investigate differences in physiological reactivity during the writing sessions, a 2 (group) × 2 (gender) × 3 (writing session) repeated-measures ANOVA was conducted with HR change score as the dependent variable.[1] Findings indicated a significant condition by time interaction (F[2,83] = 4.31, $p < .05$, $r_{\text{effect size}} = 0.22$) with follow-up tests indicating that disclosure participants exhibited significantly greater HR reactivity during the first writing session (mean = 10.40, SD = 1.1) relative to the participants assigned to the control condition (mean = 4.21, SD = 1.1, $p < .01$, $r_{\text{effect size}} = 0.42$).[2] No significant group differences in HR reactivity were found for the remaining writing sessions and there were no significant changes in HR noted across the sessions. Contrary to our predictions, no significant gender differences in HR were revealed (three-way interaction $r_{\text{effect size}} = 0.02$). Figure 1 displays HR change score in response to each writing session as a function of condition.

To examine the relationship between HR reactivity and outcome, Pearson correlations between HR reactivity to the first writing session and change scores (baseline–follow up) for each of the outcome measures were computed for the disclosure participants only. Findings indicated a significant association between HR reactivity to the first session and reductions in depressive symptoms ($r = 0.23$, $p < .05$) and physical health complaints ($r = 0.28$, $p < .05$). That is, greater HR reactivity to the first writing session was significantly associated with greater reduction in depression symptoms and physical symptom complaints. However, the relationship between HR reactivity to the first session and changes in anxiety and stress symptom reporting was not significant (largest $r = 0.10$).

DISCUSSION

Although there has been much speculation that men may experience greater benefits from the written disclosure procedure than women, results of this study indicated that men and women show comparable psychologic and physical health benefits. Data from the present study contradict findings from Smyth's metaanalysis (3) in which he examined the effect of gender on written disclosure outcome by comparing the results of studies with a higher proportion of male participants with results from studies with a higher proportion of female participants. Importantly, the studies included in Smyth's metaanalysis that had a higher proportion of men differed in a critical way from the studies that had a higher proportion of women. More specifically, studies with a greater number of men tended to examine noncollege samples (e.g., white collar professions, prison inmates, third-year medical students), whereas studies with a greater number of women tended to examine college (freshman) undergraduate participants.

[1]Gender differences in baseline HR was first examined by conducting a t test, which indicated no significant gender difference in baseline HR. Therefore, baseline HR was not included as a covariate in subsequent HR analyses. Average baseline HR was 72.4 (SD = 11.2) and 75.8 (SD = 9.6) for men and women, respectively.

[2]Degrees of freedom in analyses of HR reactivity varied as a result of missing data resulting from technical error.

The difference in sample types suggests the possibility that Smyth's findings may have been the result of some variable other than gender. It is also important to note that the findings reported here are consistent with a recent study by Sheese et al. (28) who examined gender as a moderator of written disclosure outcome through e-mail in a large (i.e., 546) college-aged sample. More specifically, Sheese and colleagues found that although written disclosure by e-mail did result in beneficial effects for health, gender did not affect outcome. Thus, in both the study reported here and in the Sheese et al. study, male and female college students equally benefited from written disclosure.

In addition to finding that men and women equally benefited from written disclosure, we also found that the process variables associated with written disclosure did not differ between men and women. That is, men and women assigned to the disclosure condition did not significantly differ in the extent to which they used emotion and insight/causality-related words. Given that there were no gender differences in outcome effects, it is not surprising that men and women assigned to the written disclosure condition did not show significantly different HR reactivity to the writing sessions. Taken together, these results indicate that men and women equally benefit from the written disclosure procedure, and that the process of written disclosure appears to be similar for men and women.

All of the participants in this study were college students, as was also the case in the Sheese et al. study (28), and this fact might help account for our null gender difference findings among disclosure participants. More specifically, male college students have been shown to be more psychologically healthy, more feminine, and more emotionally expressive than men in the general population (29). Consequently, it will be important to continue to examine the influence of gender on effects of written disclosure with participants drawn from settings other than college campuses.

Although no significant gender differences were found, a number of other significant findings did emerge. First, participants assigned to the disclosure condition reported fewer depression, anxiety, and stress symptoms at follow up compared with participants assigned to the control condition. This is noteworthy because the findings reported in other studies examining psychologic outcome have been mixed (2). One important difference between this study and previous studies is that in previous studies, the psychologic measure was most often a mood measure that consisted of a single item and/or had unknown psychometric properties. Consequently, the null effects for psychologic outcome found in other studies may have resulted from limitations of the measure used to index psychologic health. In addition, some investigators have examined psychologic heath using a measure of posttraumatic stress with college students, who likely show a restricted range of reporting with such a measure. In this study, we used a measure of psychologic health with strong psychometric properties that assessed several areas of psychologic functioning. Of course, the same issue of restricted range of reporting (or floor effects) applies to this study because we also used a college student sample and the average score on the subscales of psychologic health was relatively low at baseline. Thus, the significant findings for psychologic outcome noted here could be viewed as somewhat remarkable. The findings also highlight the importance of assessing a variety of psychologic symptoms when examining psychologic outcome associated with written disclosure.

Other important findings were that participants assigned to the written disclosure condition exhibited significantly elevated HR reactivity to the first writing session relative to the control participants and that this reactivity pattern was associated with changes in psychologic (depressive) and physical symptom reports. These findings are consistent with those reported by Sloan and colleagues (14–16) with samples of trauma survivors and suggests that, even among a group of randomly selected individuals without clinically significant baseline levels

of psychopathology, written disclosure procedure is able to evoke substantial increases in HR reactivity. Furthermore, this initial physiological reactivity may be important to the change process associated with written disclosure. The reason for the initial HR reactivity, which does not continue in subsequent sessions, is unclear. One possibility is that the initially high HR reactivity observed among the disclosure participants represents a single session exposure. However, given what is known about the number and duration of exposures necessary for successful extinction of pathologic fear response to occur (30), and that this sample was not selected on the basis of high fear response, it seems unlikely that a single session exposure explanation accounts for the pattern of HR observed in this study. Another possibility is that the disclosure participants show a high HR reactivity in response to the first session only because the first writing session has prompted them to continue to think about (process) the traumatic experience. That is, the (physiological) extinction response occurs sometime between the first and second writing session. This explanation is speculative, but anecdotal information from participants is consistent with such an explanation. In debriefing participants, they frequently note that they have spent much time in between the sessions thinking about the topic of their writing. This suggests that it may be fruitful to collect momentary data between written disclosure sessions to more accurately examine factors that contribute to beneficial outcome. Another possibility is that the initial HR reactivity is merely reflective of novelty of the task. However, this explanation seems unlikely given that this study and others (14–16) have found physiological reactivity to be significantly associated with beneficial outcome.

Although the findings of this study are intriguing, several limitations should be noted. First, the sample examined in this study consisted of college students who were not preselected on the basis of psychologic or physical health problems. Although similar samples have been frequently used to study the written disclosure procedure (5,6,9,12,29,31), the results obtained with this type of sample may not generalize to the general population. Additionally, as previously noted, the use of a college student sample may have influenced the findings with regard to gender. The follow-up period used in this study may represent another limitation. Specifically, different outcome effects might have been observed with a shorter or longer follow-up assessment period. For instance, in a previous study (15), we found reductions in physical and psychologic symptoms for participants assigned to a written disclosure condition continued to increase at a 2-month follow-up assessment relative to 1-month follow up. Although beyond the scope of this study, it would be of interest for future studies to include multiple follow-up assessments to investigate the duration of the beneficial effects associated with written disclosure. Another limitation is that physical health was solely assessed through self-report. The use of other, more objective measures of physical health such as the number of visits to the campus health center might have led to different results. Unfortunately, the use of such indices of physical health was not feasible here as a result of the large number of students who lived off campus and therefore do not use such on-campus services. Importantly, the number of health center visits may not be as reliable a measure of physical health as one might expect. For instance, Pennebaker and Francis (12) reported that less than half of the participants reported visiting the campus health center. We have obtained similar findings in our work despite the majority of participants reporting multiple days sick (14), suggesting that a large proportion of students do not use campus health center services even when they are ill. Nonetheless, it is important to consider some other reliable and objective measure of health outcomes in future investigations.

The manner in which we examined language use may also have affected our findings. In this study, we used a software program (LIWC2001) to investigate the use of emotion and insight/causality-related words. We selected the LIWC2001 computer program because it is the most commonly used a method of examining patterns of word use during written disclosure (1). However, this approach is not without its limitations. Although the LIWC2001 program accurately places words into linguistic categories, the program cannot assess other qualitative

aspects of the narrative that have been speculated to be important for successful emotional processing such as depth of emotion, cohesion, and level of detail (30). Although the LIWC2001 is easy to use and useful for certain purposes, it may be best used in conjunction with a method that is able to capture the more subtle, qualitative aspects of the written narratives.

In summary, the results of this study indicate that writing about stressful experiences with a focus on emotional expression results in beneficial psychologic and physical health outcome in a healthy college student sample. However, despite speculation to the contrary, men and women appear to derive comparable benefits from written emotional disclosure, at least in a college student sample. Furthermore, the path that men and women take to achieve these beneficial effects appears similar in terms of linguistic content of the narratives and physiological responding to the written disclosure sessions. There is clearly a long line of work demonstrating the beneficial effects of written disclosure. What is needed now is a better understanding of who written disclosure works best for (ethnicity, age, individual differences) and under what conditions (e.g., number of writing sessions, duration of sessions, time between sessions, condition under which writing occurs). By addressing these questions, we will advance our understanding of the written disclosure procedure and be able to use this promising procedure most effectively.

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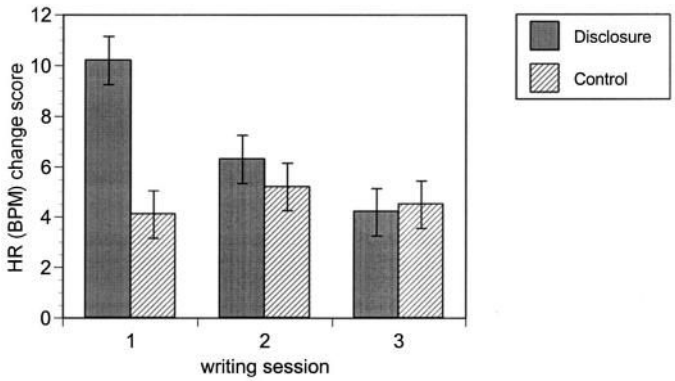

Figure 1.
Average heart rate change score as a function of writing session and condition. Bars represent standard error.

TABLE 1

Frequency (and Percentage) of Most Common Disclosure Group Essay Topics

Essay Topic	
Death of family member or friend	30 (19.6)
Illness or injury	30 (19.6)
Family conflicts	27 (17.7)
Adjustment issues	20 (13.1)
Physical or sexual assault	15 (9.8)

Total number of essays = 153.

TABLE 2

Means (and SD) at Baseline and Follow-up Assessment as a Function of Condition and Gender

Outcome Measure	Disclosure		Control	
	Men (*n* = 26)	Women (*n* = 25)	Men (*n* = 22)	Women (*n* = 21)
$DASS_{21}$ Depression				
Baseline	7.54 (1.80)	7.76 (1.84)	7.28 (1.96)	8.38 (2.00)
Follow-up	3.23 (1.42)	2.88 (1.45)	7.91 (1.54)	9.14 (1.58)
$DASS_{21}$ Anxiety				
Baseline	3.92 (1.13)	6.16 (1.15)	3.36 (1.23)	4.00 (1.25)
Follow-up	2.08 (1.00)	2.96 (1.02)	5.55 (1.09)	4.48 (1.12)
$DASS_{21}$ Stress				
Baseline	10.15 (1.65)	11.20 (1.67)	5.91 (1.80)	9.24 (1.84)
Follow-up	4.00 (1.34)	4.24 (1.36)	7.18 (1.45)	10.76 (1.49)
PILL				
Baseline	14.88 (2.42)	16.32 (2.42)	13.59 (2.58)	13.00 (2.65)
Follow-up	7.68 (1.73)	11.24 (1.73)	16.00 (1.85)	14.24 (1.89)

$DASS_{21}$ = Depression and Anxiety Symptom Scale; PILL = Pennebaker Inventory of Limbic Languidness.

TABLE 3

Mean (and SD) of LIWC Indices as a Function of Condition and Gender

	Disclosure		Control	
LIWC Category	**Men (*n* = 26)**	**Women (*n* = 25)**	**Men (*n* = 22)**	**Women (*n* = 21)**
Positive emotion	0.87 (0.33)	0.93 (0.72)	0.52 (0.23)	0.44 (0.23)
Negative emotion	1.18 (0.44)	1.30 (0.51)	0.30 (0.25)	0.28 (0.25)
Cognitive mechanism	3.33 (0.85)	4.21 (1.08)	1.81 (0.75)	1.92 (0.67)